

# The International Undergraduate Journal For Service-Learning, Leadership, and Social Change

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Volume 7 | Issue 2

Article 7

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February 2018

## Measuring Impact of Female Leaders on Education Investment In India From 2003-2014

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### Recommended Citation

Lann, Timothy and Lee, Yong Sook (2018) "Measuring Impact of Female Leaders on Education Investment In India From 2003-2014," *The International Undergraduate Journal For Service-Learning, Leadership, and Social Change*: Vol. 7: Iss. 2, p. 34-52.  
Available at: <https://opus.govst.edu/iujsl/vol7/iss2/7>

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# Measuring Impact of Female Leaders on Education Investment In India From 2013=2014

## Abstract

In this continuation of Esther Duflo's in depth research from 1998-2008 on the impact of female leaders in India, the goal was to measure whether regions with a female Chief Minister (head of state) has resulted in an increase in education investment compared to the regions where men have remained dominant in leadership roles. To do this, six regions in India with female Chief Ministers are analyzed and six with male Ministers are analyzed for comparison. Regional government education and investment expenditure data from the Indian Government is used for analysis across states in India from 2003-2014. It is determined female leadership increases education investment at a statistically significant level ( $P\text{ Val} = .1$ ).

## Introduction

The topic of female leadership and gender equality in government is one of the most talked about issues in the world. Many people argue that creating a gender equal society is one of the most important issues of our generation. India is an ideal location to study the effects of gender equality in leadership because it has been one of the worst countries in the world statistically when it comes to gender equality. Ranked 87<sup>th</sup> out of 136 countries for the Gender Gap Index (GGI) in 2016 (Forum) and 132<sup>nd</sup> out of 148 countries for the Gender Inequality Index (GII) in 2012 (Program), India still has major improvements that need to be made. India however, is making large strides to improve equality. India moved up from 101<sup>st</sup> to 87<sup>th</sup> on the GGI scale from 2012 to 2016 (Forum) and research on women in India has documented changing perceptions throughout the country. With research continuing to show that organizations and governments with more women leaders are more successful (Anderson), a reflection on the impacts of India's gender equality improvements should reveal some interesting results.

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## **Background**

Research from the early 2000's by J-PAL documented the changing perceptions of female leaders and how these changing views of powerful women were the key to unlocking greater educational achievement by women and society as a whole (Pereira). Many non-profits working in India, such as Asha For Education, base their work off the hypothesis that educating women and working for more women leaders will result in better education and education investment across the country (Asha). Now almost 10 years after much of the influential research from Duflo, looking at the data on education investment will allow us to test the hypothesis that having women leaders results in better education outcomes.

## **Research Question**

Does having a female Chief Minister in a state in India result in an increase in investment in education and females passing the high school literacy exam?

## **Literature Review**

Most of the research centered around women leaders in India and education were during the time period of 1998-2010. It was during this time that India started to transition to a more gender equal society. Initiatives such as instituting an "affirmative action" policy that created quotas for the number of women leaders in a region helped create more positive perceptions of females in power and increased the aspirations of young girls (Duflo).

A 2013-2016 study by J-PAL (Field) evaluated government incentives and the impact they had on women's labor force participation. By offering women individual bank accounts and thus more control of their financial future, researchers found an increase in women's labor force participation. A 2003-2006 study by J-PAL (Jensen) found that an increase in labor market opportunities and labor force participation resulted in women having children later in life and marrying later, both key indicators of individual well-being and economic growth. A 1998 to 2008 in depth study by J-PAL (Beaman) reviewed 495 villages and found that when quotas were created for female leaders in government, positive perceptions of female leaders increased and women's electoral chances in general improved. The one question about this study is that little is known about how this will affect perceptions of women leaders in the long run. Hopefully, these positive perceptions will continue to grow and more great female leaders will emerge. Finally, a 2006-2007 study by J-PAL (Beaman) found that in the same 495 villages studied in the 1998-2008 research, when a female was in charge, parent's aspirations for their daughters increased and adolescent girls had higher aspirations for themselves. This research was done through surveying. This research is a follow up to the work of Duflo and Beaman. This team showed the

perceptions of female leaders was changing in India and seemed to show causality between female leadership and education for girls. Does the government investment data back up the psychological results shown by J-PAL? My research seeks to prove this.

My research differs from the current literature because of two main factors. First, my research is a summary and analysis instead of an RCT and controlled experiment. Most developmental research today tests a hypothesis through these methods, but I don't have the timeframe or resources to do an RCT. Also, my research will incorporate economic growth indicators and data into the analysis whereas most of the J-PAL research and tests focus on surveying.

### Methodology and Research Design

Does having a female leader increase education investment? To answer this question, we look at 12 states in India. 6 of these states had female Chief Ministers during the time period of 2000-2016. 6 additional states with male Chief Ministers during the same time period were

Figure 1 – (Ahoy)



Figure 1 serves as a geographic reference for the states we will be analyzing. randomly selected. Data on India was gathered for comparison from the World Bank. Investment and data on the number of girls passing the high school literacy exam every year was gathered from the Government of India Department of Statistics and the Department of Human Resources. The six states analyzed because of a female leader were (consult Figure 1): West Bengal, Tamil Nadu, Delhi, Bihar, Rajasthan and Uttar Pradesh. The randomly selected states with a male leader were: Chhattisgarh, Madhya Pradesh, Odisha (or Orissa), Tripura, Sikkim, and Mizoram. For each state, five significant columns of data were collected. A dummy variable was created signifying a female leader; 0 representing a male leader for the given year and 1 representing a female leader. The second column was the number of girls for the year who passed the end of high school literacy exam in the state. An additional column was created that measured the percent change in the number of girls passing the exam year to year. The fourth column was the total state investment in education (in Rupees). The final column measured the percent change in state education investment from year to year.

Initially, the goal was to acquire data from 2000 to 2016, however limitations from the Indian Government's Departments resulted in data only available from 2003 to 2014.

The effect of female leadership on education in India will be addressed through three main quantitative analyses. A regression will be run with percent increase in girls advancing using female leadership as the comparison variable. This regression will factor in district fixed effects and yearly fixed effects to control for the differences between states in India. A second regression will be run with the same controls for district and yearly fixed effects on the percent increase in education investment once again using female leadership as the comparison variable. These regressions will be evaluated on the coefficient on female leadership as well as the p-value signifying the significance of the result. The final part of the quantitative analysis will be a variety of scatterplots made to show the differences in both education outcomes in states with and without female leaders. These graphs will not have controls, but will simply be plots of raw data from the Indian Government.

This methodology will help me answer my research question due to quality data on states with female leaders. Thankfully, female leaders have existed in small portions in India for a long enough time period to allow for regression analysis. Stata's built in controls for district and year fixed effects will also help increase the robustness of my study.

## **Results**

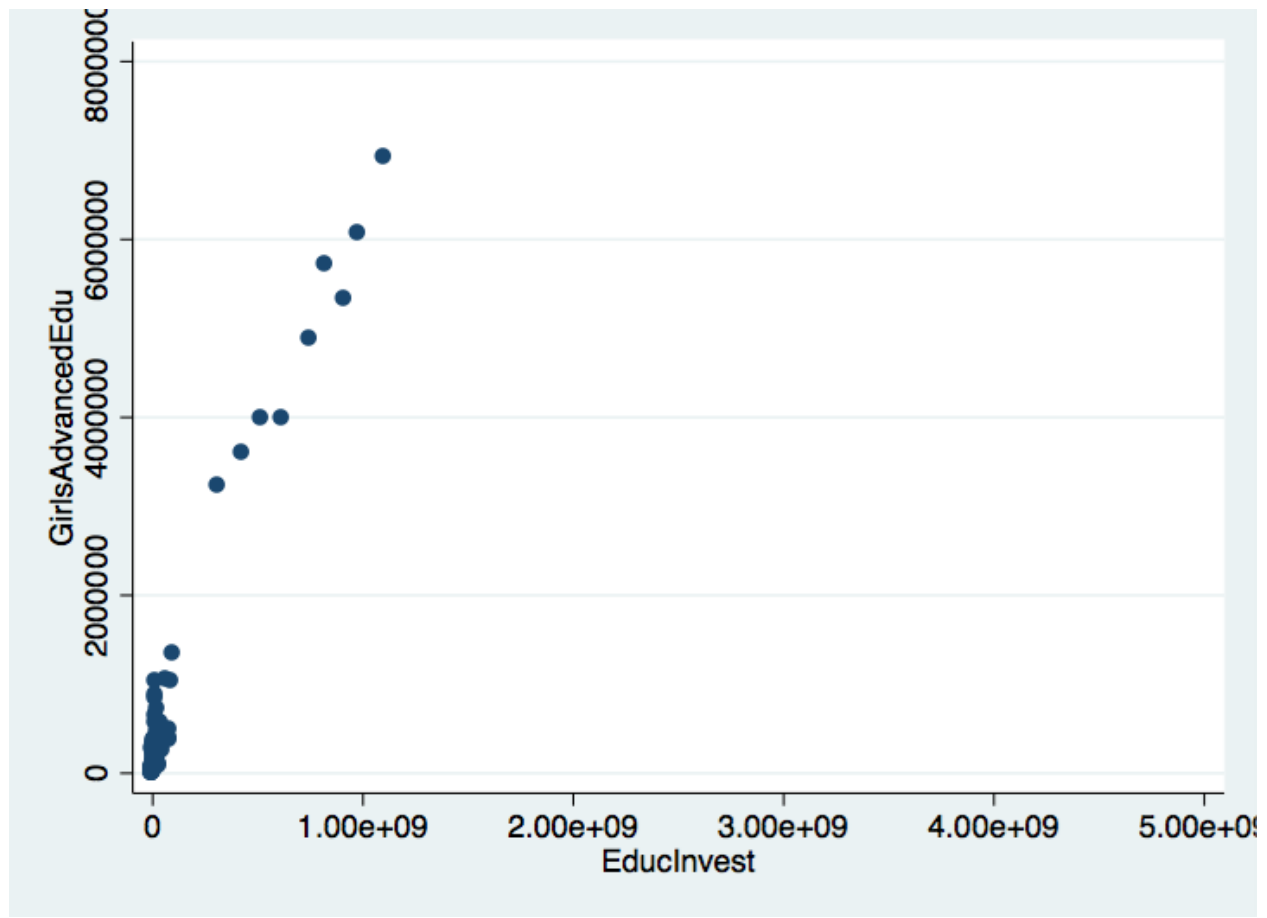
Figure 2 – (Lann)

Y – Axis = Number of Girls Passing Literacy Exam

X – Axis = Government Investment In Education

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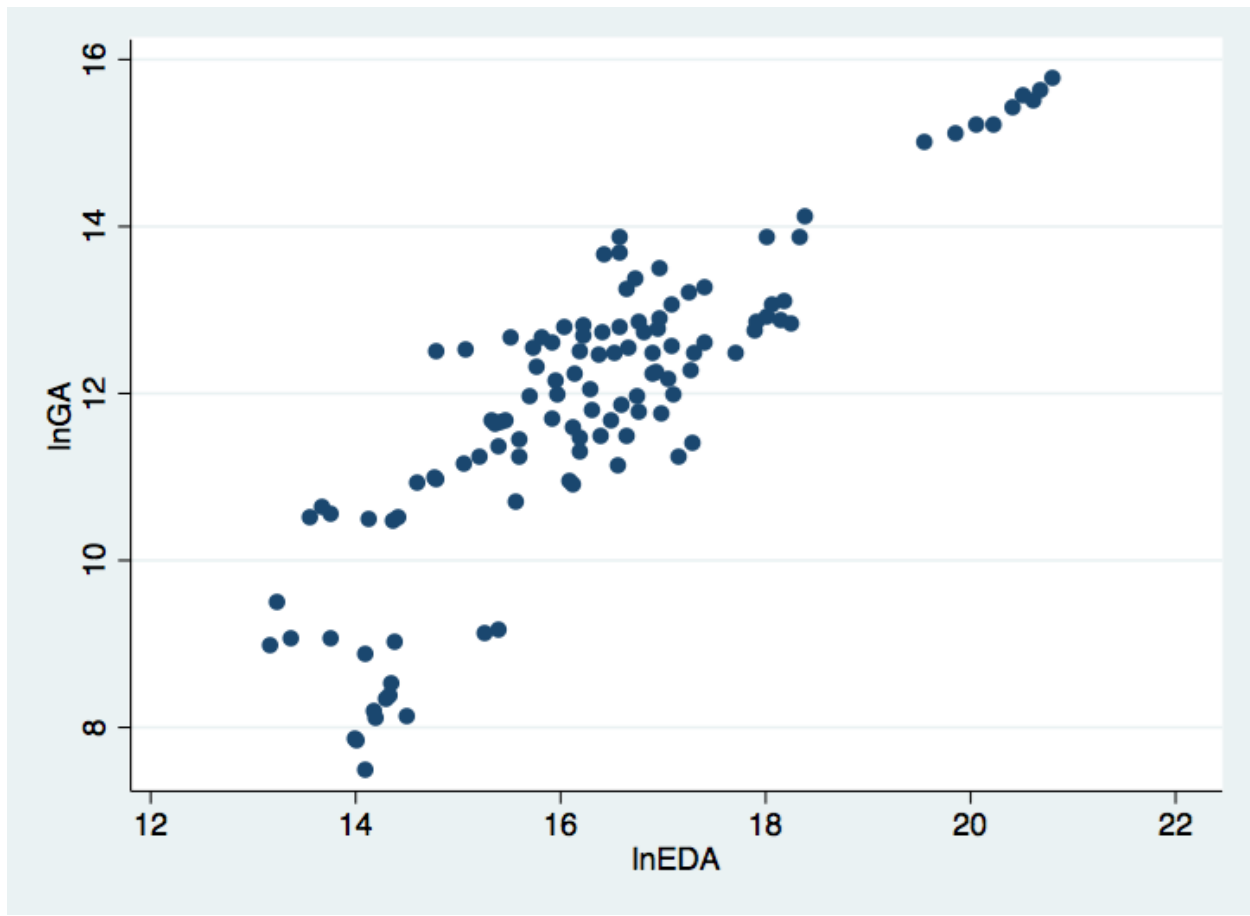


In Figure 2 we compare a linear-linear graph of Education Investment on the x-axis and Girls Advanced on the y-axis. The graph shows a clear, consistent upward trend starting around three million girls advanced. This makes sense as an increase in educational investment should result in an increase in number of girls advancing past a high school level. The one interesting result shown in this graph is the rapid increase in number of girls advanced hovering around a very low level of education investment. This shows us that in India, even a slight increase in education investment will have very large results for the poorest areas. This is consistent with most developmental economic theory that states that the largest increases in development will occur when a country is at its poorest level.

Figure 3 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam

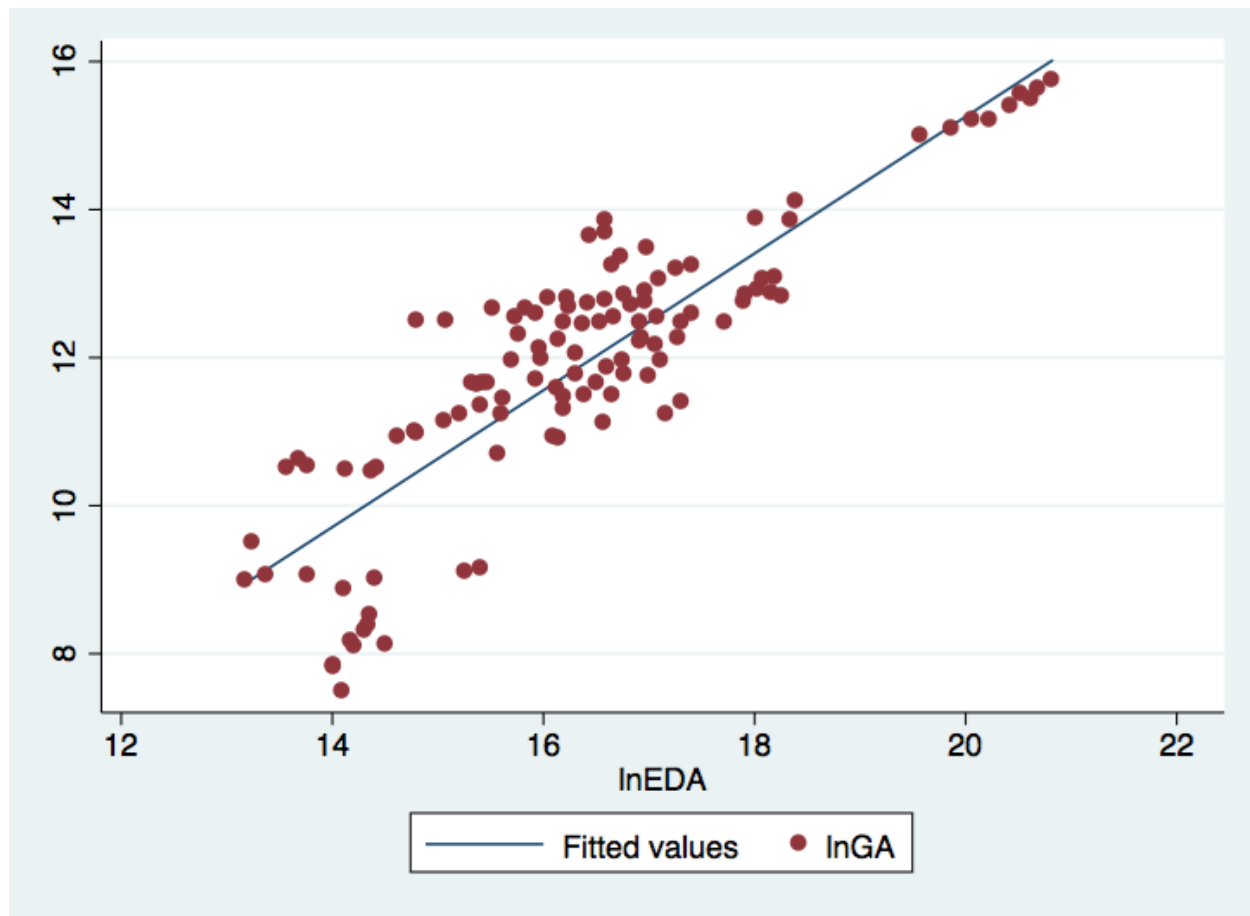
X – Axis = Percent Increase In Government Investment In Education



In Figure 3 we compare a log-log graph of the percent increase in education investment from year to year on the x-axis. This is compared to the percent increase in girls advancing on the y-axis. The most important part of this result is the top right corner of the scatterplot. We will revisit this part of the graph in later figures.

Figure 4 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam  
X – Axis = Percent Increase In Government Investment In Education

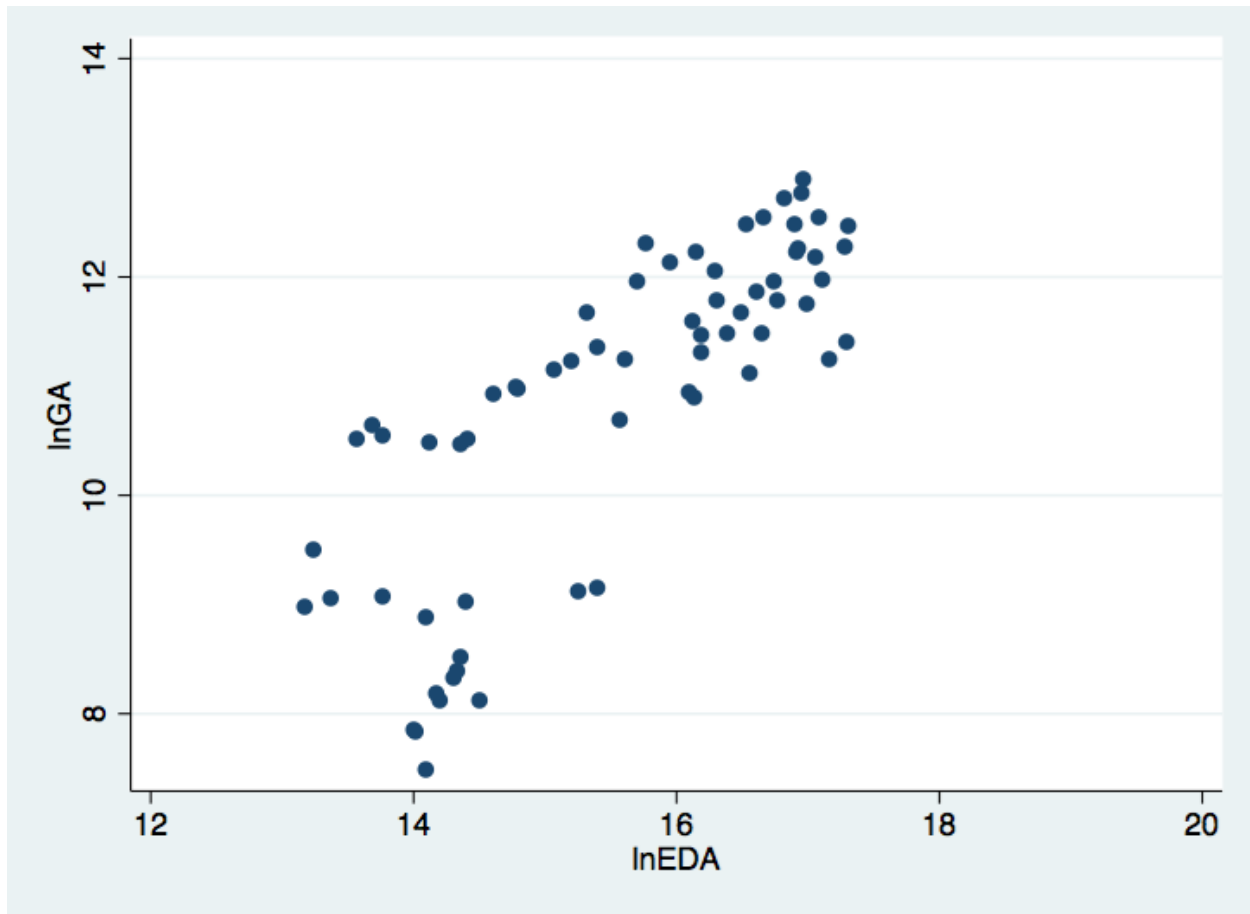


In Figure 4 we again compare a log-log graph of the percent increase in education investment from year to year on the x-axis. This is compared to the percent increase in girls advancing on the y-axis. In this graph we add in the regression line which shows the top right part of the graph is slightly below the prediction of the regression.

Figure 5 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam – **In States With Male Leader**  
 X – Axis = Percent Increase In Government Investment In Education – **In States With Male Leader**





In Figure 5 we again compare a log-log graph of the percent increase in education investment from year to year on the x-axis. This is compared to the percent increase in girls advancing on the y-axis. This graph however only looks at states with male leaders. We can see a clear trend however the most interesting result is the lack of the data points in the top right of the graph. This means only in states with female leaders were the top increases in education investment and the top increases in girl advancement observed.

Figure 6 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam – **In States With Male Leader**

X – Axis = Percent Increase In Government Investment In Education – **In States With Male Leader**

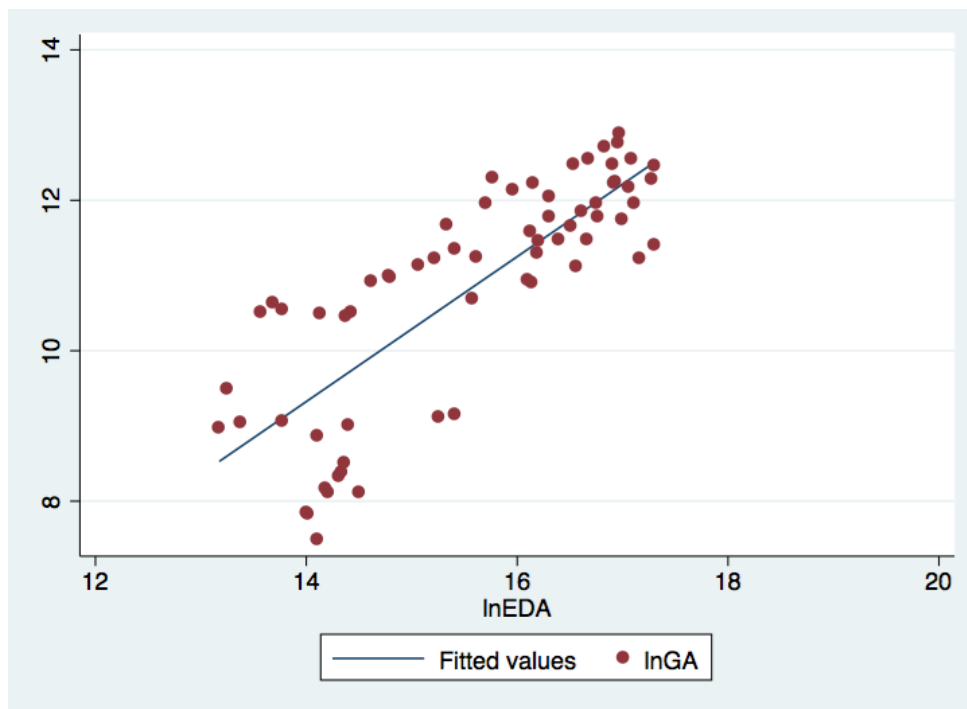
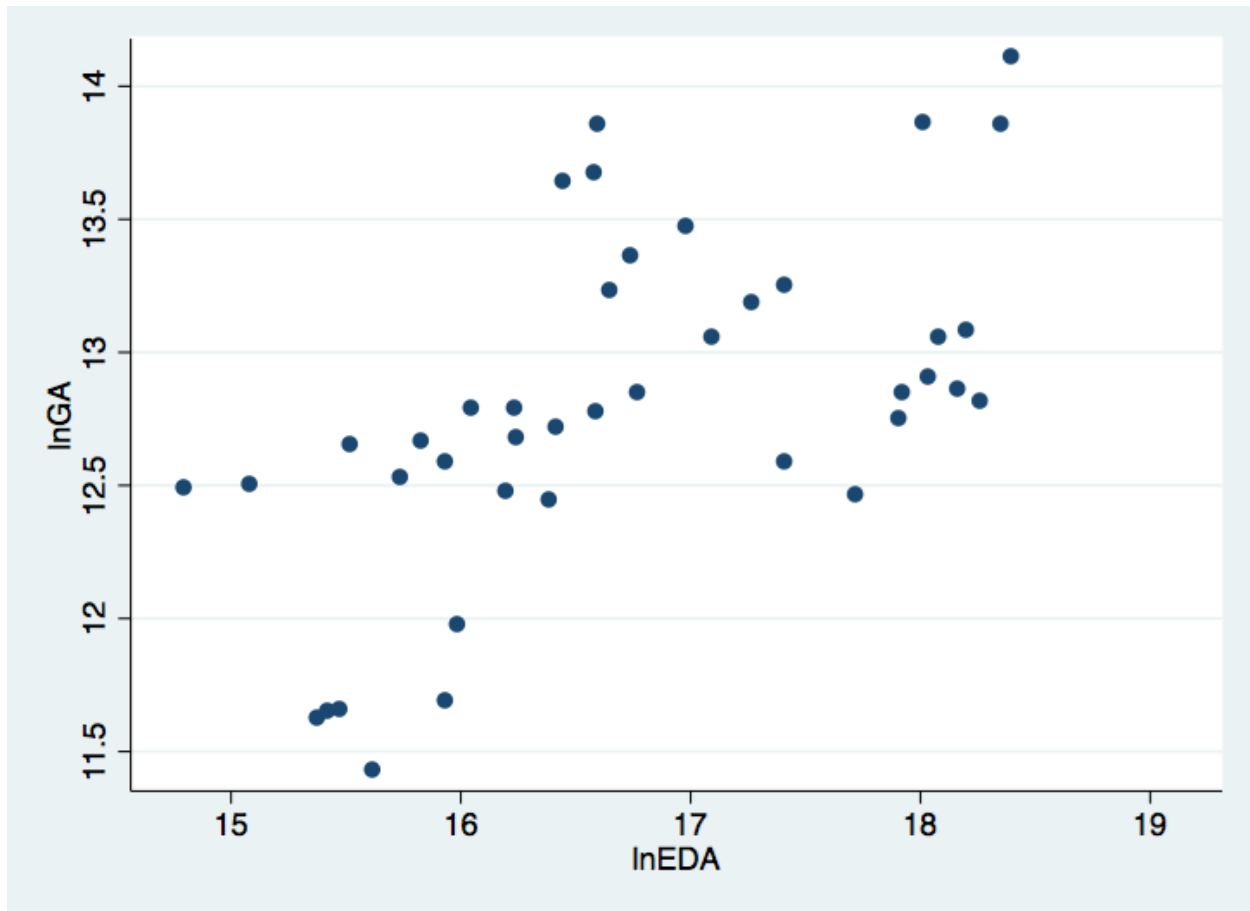


Figure 7 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam – **In States With Female Leader**

X – Axis = Percent Increase In Government Investment In Education – **In States With Female Leader**



In Figure 7 we again compare a log-log graph of the percent increase in education investment from year to year on the x-axis. This is compared to the percent increase in girls advancing on the y-axis. This graph looks at states with female Chief Ministers. This scatterplot shows a much less clear trend compared with the male leadership graphs. While a positive linear trend is still clear, it is less clustered around the best fit line (Figure 8). This means that female leaders have much less consistent results with their education policy. Hypotheses for why this is the case will be discussed further in a later section.

Figure 8 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam – **In States With Female Leader**

X – Axis = Percent Increase In Government Investment In Education – **In States With Female Leader**

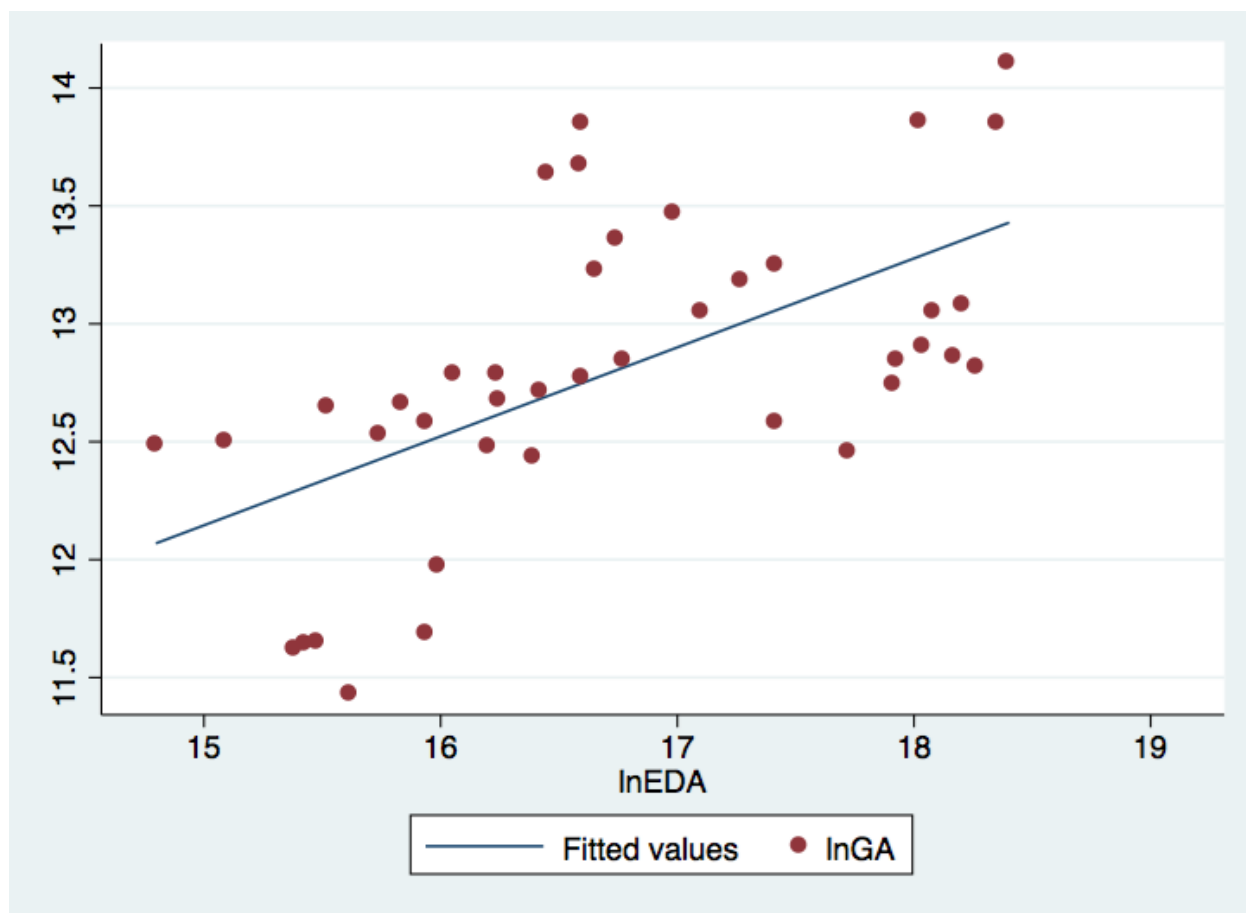


Figure 9 – (Lann)

Y – Axis = Percent Increase In Girls Passing Literacy Exam

X – Axis = Female Leader Dummy Variable – **1 = States With Female Leader, 0 = States With Male Leader**

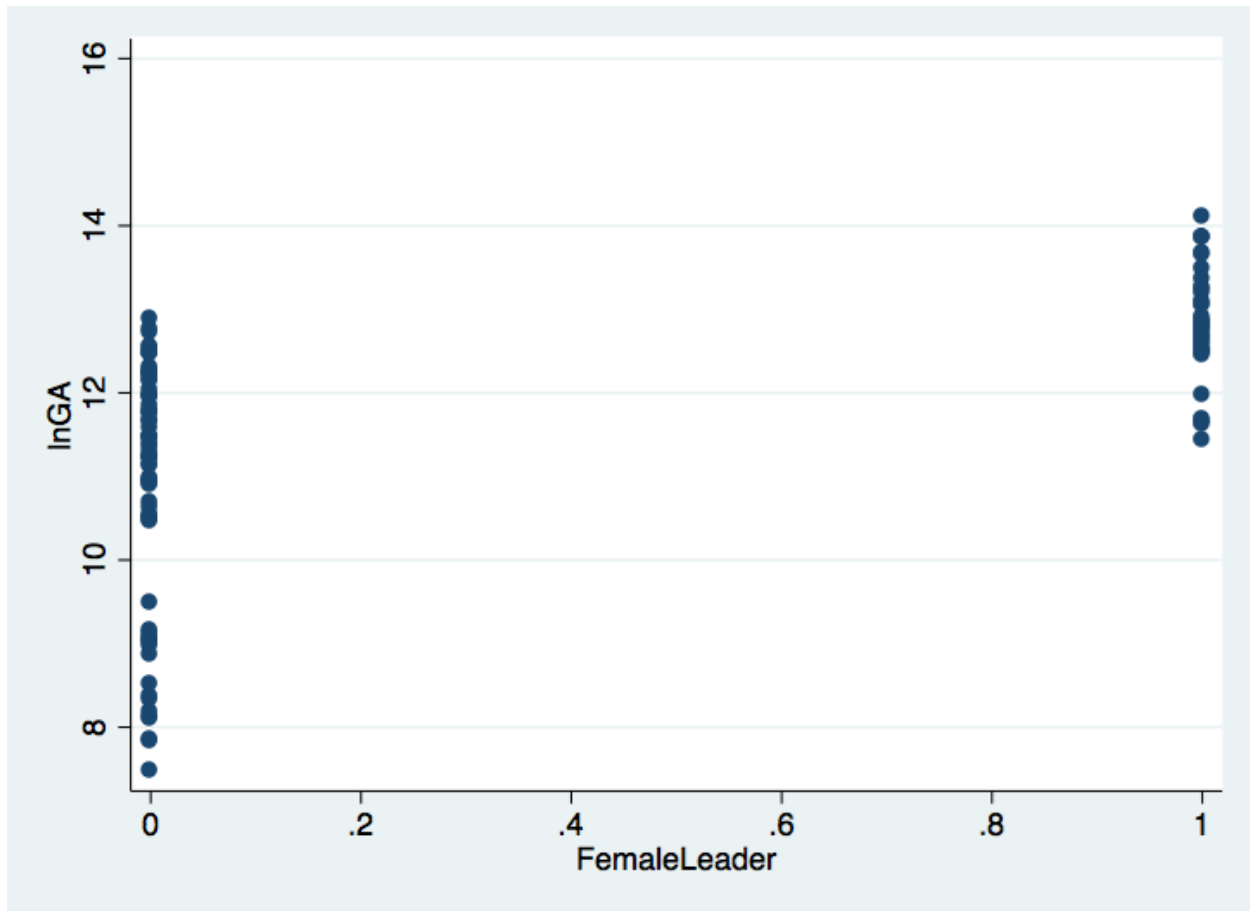


Figure 9 displays the percent increase in girls educated in a different format. The 0 column on the x-axis shows the data in states with a male leader. The 1 column shows female-led states. Because Female Leadership is a 0/1 dummy variable, there is no data between the 0 column and the 1 column. The plot shows that female leaders generally and more consistently achieve better results with education of girls. The 0-column scatter has a much larger and lower range and has a higher standard deviation.

Figure 10 – (Lann)

Y – Axis = Percent Increase In Government Investment In Education  
 X – Axis = Female Leader Dummy Variable – **1 = States With Female Leader, 0 = States With Male Leader**

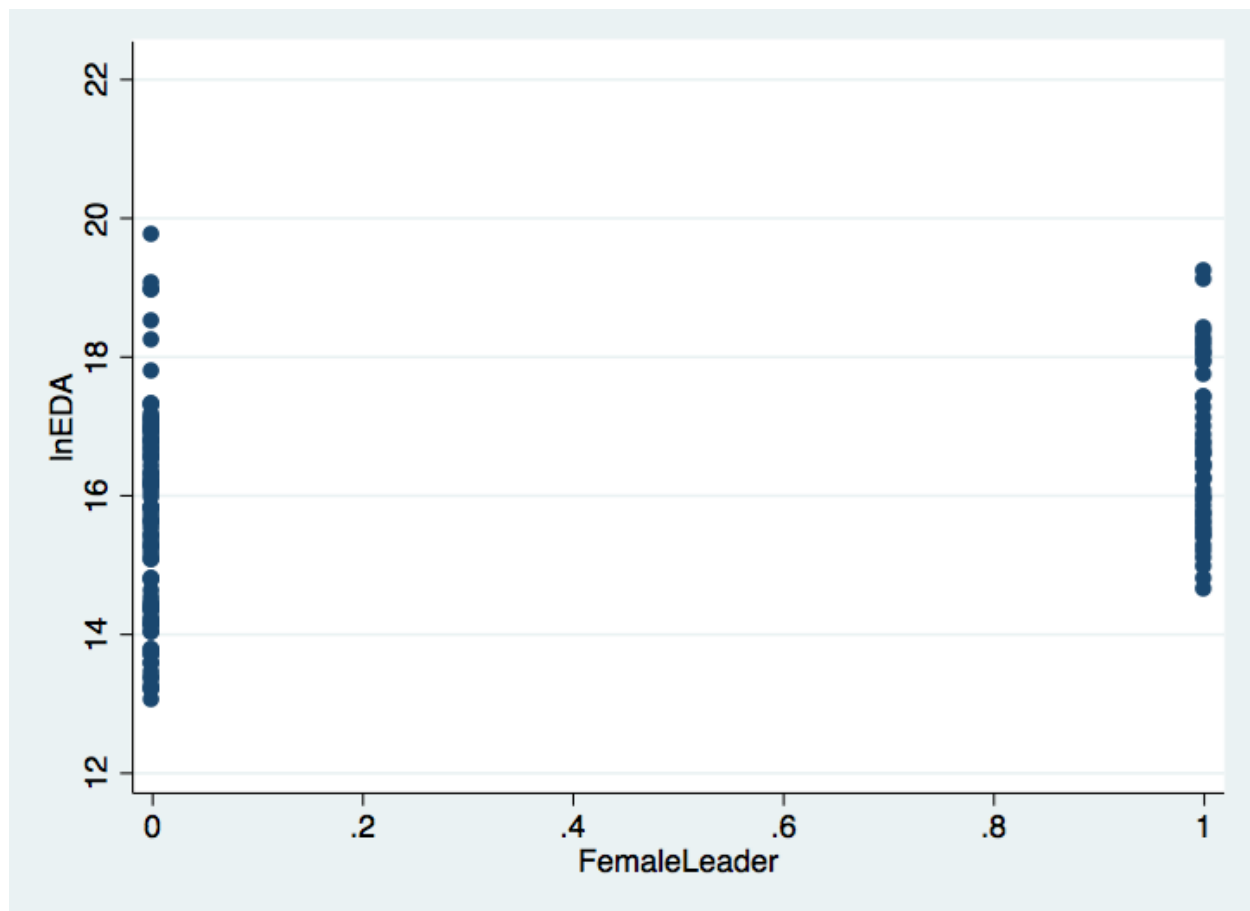


Figure 10 compares data on education investment. Similar to Figure 9, female-led regions are shown to have a lower standard deviation and better results. This figure shows less pronounced success for female leaders.

Figure 11 – (Lann)

Regression Results – Effect of Female Leader on Percent Increase In Girls Passing Literacy Exam

lnGA	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
FemaleLeader	<b>-.087548</b>	<b>.0871115</b>	<b>-1.01</b>	<b>0.318</b>	<b>-.2607198</b>	<b>.0856239</b>
Y1	0	(omitted)				
Y2	0	(omitted)				
Y3	0	(omitted)				
Y4	0	(omitted)				
Y5	0	(omitted)				
Y6	<b>-.8659063</b>	<b>.0716329</b>	<b>-12.09</b>	<b>0.000</b>	<b>-1.008308</b>	<b>-.7235049</b>
Y7	<b>-.7854406</b>	<b>.0674422</b>	<b>-11.65</b>	<b>0.000</b>	<b>-.9195113</b>	<b>-.65137</b>
Y8	<b>-.6815151</b>	<b>.0853442</b>	<b>-7.99</b>	<b>0.000</b>	<b>-.8511737</b>	<b>-.5118566</b>
Y9	<b>-.6428517</b>	<b>.0599221</b>	<b>-10.73</b>	<b>0.000</b>	<b>-.7619729</b>	<b>-.5237305</b>
Y10	<b>-.4519647</b>	<b>.0652662</b>	<b>-6.92</b>	<b>0.000</b>	<b>-.5817095</b>	<b>-.3222198</b>
Y11	<b>-.3299221</b>	<b>.0650169</b>	<b>-5.07</b>	<b>0.000</b>	<b>-.4591715</b>	<b>-.2006727</b>
Y12	<b>-.22967</b>	<b>.0617556</b>	<b>-3.72</b>	<b>0.000</b>	<b>-.352436</b>	<b>-.1069039</b>
Y13	<b>-.128733</b>	<b>.0577532</b>	<b>-2.23</b>	<b>0.028</b>	<b>-.2435426</b>	<b>-.0139234</b>
Y14	0	(omitted)				
Y15	0	(omitted)				
Y16	0	(omitted)				
Y17	0	(omitted)				
_cons	<b>12.07595</b>	<b>.0589204</b>	<b>204.95</b>	<b>0.000</b>	<b>11.95882</b>	<b>12.19308</b>
State	absorbed		(12 categories)			

Figure 11 displays the regression results run on percent increase in girls passing the high school literacy exam. The important value on the table is the coefficient of FemaleLeader which is -.0875. This is not a good result as it implies that female leadership actually has a negative impact on the increase of female education. This is obviously not a correct result and with a very high p-value of .318 we can throw this regression out. This high p-value occurred most likely due to a lack of needed data to draw a robust comparison between female education advancement and female leadership. The relationship between these two variables is much more complicated than relating female leadership to education investment and thus this regression equation needed more variables and more data. Thankfully, we can throw out this result and focus on the second regression.

Figure 12 – (Lann)

## Regression Results – Effect of Female Leader on Percent Increase In Government Investment In Education

lnEDA	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
FemaleLeader	<b>.2192998</b>	<b>.1354294</b>	<b>1.62</b>	<b>0.108</b>	<b>-.048841</b>	<b>.4874405</b>
Y1	0	(omitted)				
Y2	0	(omitted)				
Y3	0	(omitted)				
Y4	<b>-3.324251</b>	<b>.1766327</b>	<b>-18.82</b>	<b>0.000</b>	<b>-3.673972</b>	<b>-2.974531</b>
Y5	<b>-2.965234</b>	<b>.1736065</b>	<b>-17.08</b>	<b>0.000</b>	<b>-3.308963</b>	<b>-2.621506</b>
Y6	<b>-3.032011</b>	<b>.1802392</b>	<b>-16.82</b>	<b>0.000</b>	<b>-3.388872</b>	<b>-2.675149</b>
Y7	<b>-2.812797</b>	<b>.1784727</b>	<b>-15.76</b>	<b>0.000</b>	<b>-3.16616</b>	<b>-2.459433</b>
Y8	<b>-2.808304</b>	<b>.1823516</b>	<b>-15.40</b>	<b>0.000</b>	<b>-3.169348</b>	<b>-2.447261</b>
Y9	<b>-2.447481</b>	<b>.1718545</b>	<b>-14.24</b>	<b>0.000</b>	<b>-2.787741</b>	<b>-2.107221</b>
Y10	<b>-2.158149</b>	<b>.1908809</b>	<b>-11.31</b>	<b>0.000</b>	<b>-2.53608</b>	<b>-1.780218</b>
Y11	<b>-2.005058</b>	<b>.1939793</b>	<b>-10.34</b>	<b>0.000</b>	<b>-2.389124</b>	<b>-1.620993</b>
Y12	<b>-1.565609</b>	<b>.2130714</b>	<b>-7.35</b>	<b>0.000</b>	<b>-1.987475</b>	<b>-1.143742</b>
Y13	<b>-1.363688</b>	<b>.2076939</b>	<b>-6.57</b>	<b>0.000</b>	<b>-1.774907</b>	<b>-.9524683</b>
Y14	<b>-1.247853</b>	<b>.207333</b>	<b>-6.02</b>	<b>0.000</b>	<b>-1.658358</b>	<b>-.8373483</b>
Y15	0	(omitted)				
Y16	0	(omitted)				
Y17	0	(omitted)				
_cons	<b>18.07908</b>	<b>.1558545</b>	<b>116.00</b>	<b>0.000</b>	<b>17.7705</b>	<b>18.38766</b>
State	absorbed (12 categories)					

Figure 12 is the most important figure in my research. This figure displays the regression run on the percent increase in education investment due to female leadership. The coefficient on FemaleLeader is .2192 with a p-value of .1 which is a statistically significant result. This means that having a female Chief Minister significantly improves the amount of the state budget allocated to education.

### Preliminary Findings

Preliminarily it has been shown that female leaders have a statistically significant positive impact on education investment in India. Unfortunately, we were unable to demonstrate through



regression analysis that female leadership also had a positive impact on the number of girls advancing past high school. The reason the scatterplots seemed to imply such a strong impact from female leadership on girl's advancement was because the scatterplots did not have district fixed effects factored in. This means that we were unfairly comparing education outcomes across states. These results are not robust because there are a variety of factors state-to-state that have an impact on education. For example, you can't compare Texas and California education on the same level because each state has different factors. When we control for these district factors, we lose the results the scatterplots seemed to imply. However, our education investment results do back up the claim that female leadership has a positive impact on education in India.

One of the more significant findings was the top right hand corner of Figure 3 which showed the best performing regions were all led by females. Upon further examination of the data these results were spread across different states and all reflected the most significant development change in the region. This means that female leadership in multiple regions successfully developed their state ahead of schedule. This result coming despite the challenges faced by females in India.

### **Mixed Results for Female Leadership**

A few questions arise from the graphs and regression results. Why is it that there are much more inconsistent results in female-led states? (Figure 7, 8). Why are the best results in the study all in female-led states? (Figure 3,4). While the following explanations are untested and only theories, there is a fair amount of qualitative evidence to back them up.

A 2015 study by the British Council found, unsurprisingly, that female policy makers in India face significant challenges when implementing policy (Council). Many face what the Council described as "highly unfavorable workplaces". Not only do many female leaders face slander and lack of respect from their male peers but also can have more problems trying to implement their policies. This would help explain the widespread distribution in Figures 7 and 8.

Another potential reason a positive relationship between girls advancing in education and female leadership can't be shown yet is not enough time has passed since the Duflo study (Duflo, Beaman). The research showing the changing perceptions and aspirations was published nine years ago so the youngest girls who were the most affected by the changing perceptions have not yet reached an age where they can pass a high school literacy exam. Most likely we will observe an even greater increase in the coefficients on female leadership in the coming years in India.

Finally, there are a few incredible female leaders in India who are the outliers observed in the top right corner of Figures 3 and 4. Anadiben Patel of Gujarat has seen a 100% increase in school enrollment in just a few short years and has radically increased education investment (Shah). These female leaders are the examples for the rest of the country when it comes to education and also the best results in our data collection.

### **Problems With The Research**

Although good results were achieved on one of the two regressions, there were three main problems I encountered while completing this research that had an effect on the final graphs and regression analysis. These problems will need to be fixed or better accounted for moving forward with research in this field.

First, the analysis should have incorporated data from all 29 states in India, not just 12 states. This would have allowed for better control over the entire country of India and would have provided more data points potentially fixing the problematic first regression analysis.

Next, the control on population effects was limited due to the Indian census. Unfortunately, India only has a census every 10 years. This forced me to not be able to factor in the effects of population on education such as migration between states and immigration to certain states and regions.

Finally, I was limited in the most recent data on education investment and female education advancement. The Indian Government has not yet posted education data for 2015 and 2016. This is unfortunate as in these two years we were likely to begin to see the effects of Duflo's study in the data. These data points will be important to bring into the regression analysis as soon as they become available.

### **Conclusion**

Gender equality remains one of the most important issues facing our world today and one that we can realistically solve in our lifetime. With more research like this demonstrating the positive impact of female leadership around the world despite the barriers and obstacles faced by women leaders, hopefully the world will see the power of a gender equal society. Female leaders in India do have a positive impact on education investment which in the long run will improve GDP and continue to progress India to further stages of economic development. While more research and data collection is needed to robustly show the relationship between female leaders and the number of girls advancing in education each year, Duflo and Beaman can be satisfied

that their perception study has already started to have an impact as India consistently advances towards a more gender equal society. Asha For Education and other NGOs working in India will use this research to further their mission to create more highly trained female leaders at the village and state levels and work for a highly educated Indian population. While the results from Duflo and Beaman's game-changing research can not yet be fully observed, female leadership still clearly results in a better education and future for the states they lead

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**Note:** All data analysis, graphs, and regression analysis done using Stata 14, Stanford  
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